GREAT LAKES FOREST RESEARCH CENTRE
CENTRE DE RECHERCHE FORESTIÈRE DES GRANDS LACS

Results of forest insect and disease surveys in the NORTHERN REGION of Ontario, 1984

CARRIED OUT BY THE GREAT LAKES FOREST RESEARCH CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

L. S. MacLeod, C. G. Jones and A. J. Keizer

Miscellaneous Report No. 19

Canada

85-6521/

THE GREAT LAKES FOREST RESEARCH CENTRE

The Great Lakes Forest Research Centre is one of six regional establishments located across Canada and operated by the Canadian Forestry Service. The overall objective of the Service is to promote the preservation, enhancement and wise use of a healthy, attractive and bountiful forest resource and terrestrial environment for the economic and social benefit of all Canadians. The Centre pursues this objective by conducting two major programs: research and technical services and forestry development. Both programs address major problems affecting forest management and the forest environment primarily in Ontario, but because of the transprovincial nature of the forest resource, many elements of our research program are of national significance.

Forestry problems are continually assessed by the Canada-Ontario Joint Forestry Research Committee, made up chiefly of senior members of the Centre and the Ontario Ministry of Natural Resources. The Committee ensures that the research resources of both agencies are effectively transmitted to the forest managers in order to improve forest production and protection, and the quality of the environment.

Staff of the forestry development program negotiate and administer federal-provincial cost-sharing agreements with the province of Ontario, conduct economic studies, and implement job creation programs in the forest sector. Again, this requires close cooperation with the Ontario Ministry of Natural Resources and with other provincial and federal agencies concerned with the forest sector.

Close working relations are also maintained by the Centre with educational institutions specializing in forestry and the biological sciences, with the forest industry, and with other forestry organizations in the province.

The Centre recognizes that forested land must be managed in the best public interest, not only for the wood production essential to our economy but also for the recreational purposes that are so important to our social well-being. These goals must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHERN REGION OF ONTARIO, 1984

(FOREST DISTRICTS: MOOSONEE, HEARST, KAPUSKASING, COCHRANE, CHAPLEAU, TIMMINS, KIRKLAND LAKE and GOGAMA)

L.S. MACLEOD, C.G. JONES AND A.J. KEIZER

GREAT LAKES FOREST RESEARCH CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

1985

MISCELLANEOUS REPORT NO. 19

©Minister of Supply and Services Canada 1985
Catalogue No. Fo29-8/19E
ISBN 0-662-13953-4
ISSN 0826-0222

Additional copies of this publication are available at no charge from:

Information Office
Great Lakes Forest Research Centre
Canadian Forestry Service
Government of Canada
P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

SURVEY HIGHLIGHTS

The 1984 field season was highlighted by an extensive outbreak of jack pine budworm in the southern part of the Northern Region. This insect has caused little damage in northeastern Ontario for many years but now poses a potential threat to valuable jack pine stands and plantations in the districts of Chapleau, Gogama and Kirkland Lake.

High populations of spruce budworm persisted in the Hearst, Kapuskasing and Cochrane districts and egg-mass sampling indicated a continuation of infestation in 1985. Aerial spraying operations against the budworm were again carried out by the Ontario Ministry of Natural Resources (OMNR) in the Hearst District.

The black army cutworm caused considerable mortality to newly planted tree seedlings in spring plants in Hearst and Gogama districts. Yellowheaded spruce sawfly continued to damage plantations, windbreaks and snow hedges throughout the Region, necessitating control operations by OMNR and the Ministry of Transportation and Communications. The forest tent caterpillar infestation in the Matheson area of the Kirkland Lake District expanded slightly and a new outbreak of this aspen defoliator occurred in the southeastern part of that district.

On the positive side, the birch skeletonizer and spearmarked black moth infestations declined appreciably and little damage by the Swaine sawfly occurred in the Elk Lake Management Unit.

Special surveys carried out in the Region in 1984 included detailed surveys for insects and diseases affecting white spruce and jack pine plantations, examination of black spruce stands for root rots, measuring aspen stands for Hypoxylon canker, pheromone trapping for several species of insects, surveying for evidence of pinewood nematode and establishing plots to monitor the effects of acid precipitation in the boreal forest.

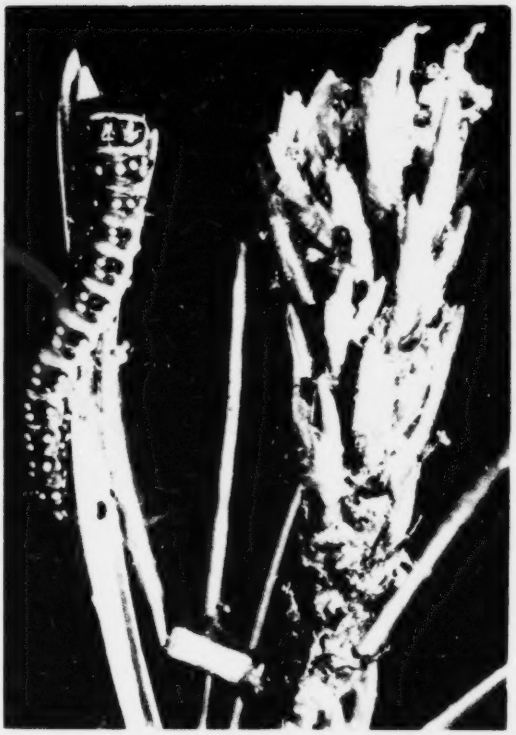
The generous assistance and cooperation extended by OMNR and woods industry personnel in all districts of the Region are gratefully acknowledged.

The same format was followed in categorizing pests as in the 1983 Northern Region report:

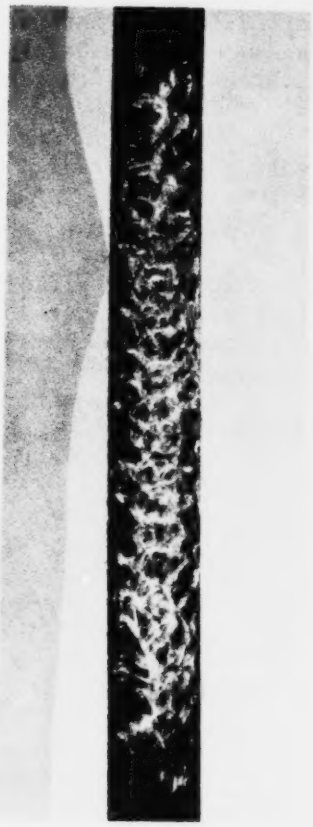
Major Insects or Diseases

capable of causing serious injury to or death of living trees or shrubs

Frontispiece



Jack pine budworm, *Choristoneura pinus pinus* Free., larvae feeding on jack pine (*Pinus banksiana* Lamb.) needles



Jack pine budworm egg-mass on needle

Jack pine trees severely defoliated by the jack pine budworm

*Minor Insects or Diseases**

capable of sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

1) those which are of minor importance and have not been known to cause serious damage to forest trees,

2) those which are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1984.

*No minor insects were reported in the Northern Region in 1984.

L.S. MacLeod

C.G. Jones

A.J. Keizer

TABLE OF CONTENTS

Page

INSECTS

Major Insects

Black Army Cutworm, *Actebia fennica* 1
(Hearst, Gogama districts)

Spruce Budworm, *Choristoneura fumiferana* 1
(All districts)

Jack Pine Budworm, *Choristoneura pinus pinus* 1
(All districts)

Birch Skeletonizer, *Bucculatrix canadensisella* 3
(All districts)

Eastern Pine Shoot Borer, *Eucosma gloriola* 3
(All districts)

Birch Leafminer, *Fenusa pusilla* 3
(All districts)

American Aspen Beetle, *Gonioctena americana* 11
(All districts)

Forest Tent Caterpillar, *Malacosoma disstria* 11
(Kirkland Lake District)

Whitespotted Sawyer Beetle, *Monochamus scutellatus* 11
(All districts)

Jack Pine Sawflies, *Neodiprion* spp. 13
(All districts)

Swaine Jack Pine Sawfly, *Neodiprion swainei* 13
(Kirkland Lake District)

Aspen Leafblotch Miner, *Phyllonorycter ontario* 14
(All districts)

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* 14
(All districts)

White Pine Weevil, *Pissodes strobi* 15
(All districts)

Larch Sawfly, *Pristiphora erichsonii* 15
(Hearst, Kapuskasing and Chapleau districts)

(continued)

TABLE OF CONTENTS (continued)

Page

Major Insects (concluded)

Mountain-ash Sawfly, *Pristiphora geniculata* 17
(All districts)

Spearmarked Black Moth, *Rheumaptera hastata* 17
(Chapleau District)

Other forest insects 17

TREE DISEASES

Major Diseases

Armillaria Root Rot, *Armillaria mellea* 23
(All districts)

Spruce Needle Rusts, *Chrysomyxa ledi* and *C. ledicola* . . . 24
(All districts)

Ink Spot of Aspen, *Ciborinia whetzelii* 24
(All districts)

Pine Needle Rust, *Coleosporium asterum* 29
(Hearst and Cochrane districts)

Sweetfern Blister Rust, *Cronartium comptoniae* 29
(Chapleau, Cochrane and Timmins districts)

Hypoxylon Canker, *Hypoxylon mammatum* 30
(All districts)

Minor Diseases

Leaf Spot, *Mycosphaerella populicola* 30
(All districts)

Shoot Blight, *Venturia macularis* 30
(All districts)

Other forest diseases 34

(continued)

TABLE OF CONTENTS (concluded)

Page

SPECIAL SURVEYS

White Spruce Plantations 36
(Chapleau, Gogama, Kirkland Lake, Cochrane, Hearst and Kapuskasing districts)

White Spruce Seed, Cone and Flower Pests 38
(Chapleau, Gogama, Hearst and Kirkland Lake districts)

Black Spruce Root Rot Survey 43
(Chapleau, Timmins, Kirkland Lake, Cochrane, Hearst and Kapuskasing districts)

Permanent Jack Pine Sample Plots 46
(Chapleau, Timmins, Kirkland Lake, Cochrane and Hearst districts)

Pinewood Nematode, *Bursaphelenchus xylophilus* 49
(All districts)

Acid Rain Early Warning System 49
(Chapleau and Kapuskasing districts)

Gypsy Moth Pheromone Traps 49
(All districts)

Climatic Data 50
(Chapleau, Kirkland Lake and Kapuskasing districts)

INSECTS

Major Insects

Black Army Cutworm, *Actebia fennica* (Tausch.)

The black army cutworm was for some time known only as a sporadic pest of herbaceous agriculture crops in central North America. Recently, it has also been recognized as a pest of newly planted conifer seedlings in eastern and western Canada (see photo page). The continuing increase in reforestation with seedlings on burned areas will further increase its importance. The destructive stage is a black larva with two double white lines on either side of the body. It is about 5 mm long early in May, attaining to about 40 mm in early June (see photo page).

Severe damage by this cutworm occurred in Township 239, Hearst District, where a 250-ha prescribed burn was being planted with 8-month-old black spruce (*Picea mariana* [Mill.] B.S.P.) stock. Larvae were so numerous in this area that approximately 88,600 trees already in the ground were destroyed and planting operations were suspended. A progeny test plot within the area was hand-sprayed on 31 May by the Ontario Ministry of Natural Resources (OMNR) using Sevin (250 g/ha) to control the cutworm. A similar situation occurred in an 80-ha tree stand in Miramichi Township, Gogama District. In this area, 2-0 jack pine (*Pinus banksiana* Lamb.) stock were much less severely damaged, with 5-10% of the trees destroyed. Tree mortality at this location may have been reduced because of the availability of herbaceous plants and small shrubs which the larvae apparently preferred.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Results of damage surveys, population sampling and egg-mass counts of this perennial pest will be published with those of other regions at a later date in a report specifically devoted to this insect. That report will provide a complete description and analysis of developments in the spruce budworm situation in Ontario in 1984 and will give infestation forecasts for the province for 1985.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

A substantial outbreak of the jack pine budworm occurred in 1984 encompassing part of three districts in the Region (see Frontispiece). Infestations totalling 171,595 ha were composed of thirty scattered pockets in the districts of Chapleau, Gogama and Kirkland Lake (Fig. 1). In the Chapleau District, moderate-to-severe defoliation was mapped from north of Wakami Provincial Park, south to Deans and Cassidy townships, and east to the Gogama District, an area of approximately 95,598

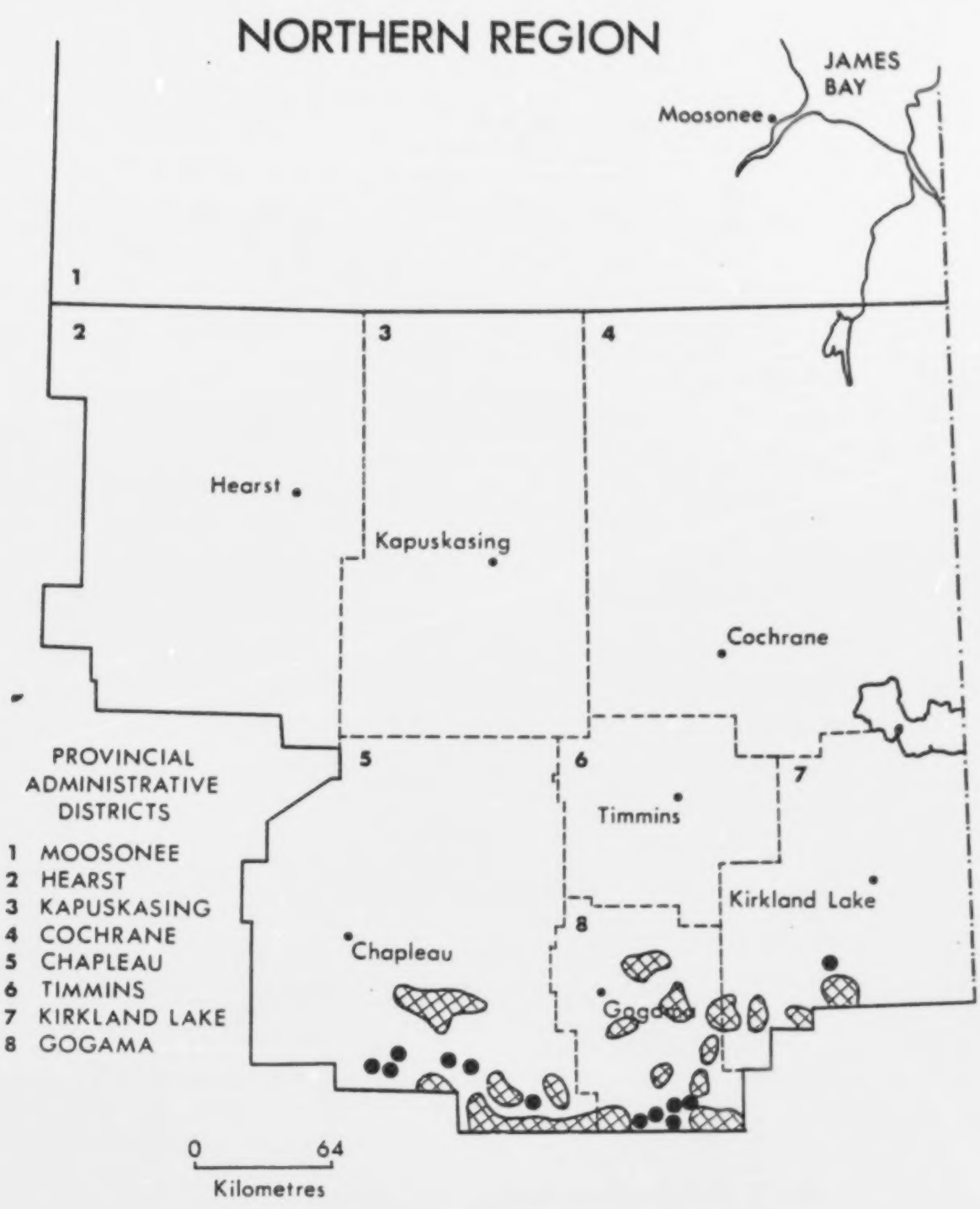


Figure 1. Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Areas within which defoliation of jack pine (*Pinus banksiana* Lamb.) occurred in 1984

Moderate-to-severe . . . ▨ or ●

ha. Infestations in the Gogama District were found from north of Gogama, south to the Sudbury District border, and totalled 49,102 ha. In the Kirkland Lake District severe defoliation was confined to five areas in the southern part of the district totalling 26,895 ha.

Egg-mass sampling similar to that used to forecast spruce budworm populations was carried out at 94 locations in the Region. Although this method is less precise in forecasting jack pine budworm infestations, results of the survey indicate that infestations will recur in all three districts in 1985 (Table 1).

Birch Skeletonizer, *Bucculatrix canadensisella* Cham.

The general decline in the birch skeletonizer infestation reported in 1983 continued in 1984. No defoliation was observed in white birch (*Betula papyrifera* Marsh.) stands in the Hearst, Kapuskasing and Timmins districts and damage was confined to moderate skeletonizing of ornamental trees in the town of Iroquois Falls in the Cochrane District. Populations were higher in the Kirkland Lake District and two areas of moderate-to-severe defoliation totalling 36,069 ha were mapped in the central part of the district (Fig. 2). In the Gogama District, moderate-to-severe foliar discoloration occurred over a total area of approximately 15,800 ha, primarily around the shorelines of major water bodies.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

The eastern pine shoot borer which infests all species of pine was widely distributed through jack pine plantations in the Region. Leader mortality varied considerably from district to district (Table 2). When the leader is killed and one of the lateral shoots becomes the new leader, a crooked stem results.

Birch Leafminer, *Fenusa pusilla* (Lep.)

Since its introduction into North America in 1923 in Connecticut, this miner has spread across the United States and is now found in Canada from Newfoundland to Alberta. There are three or four generations each year, depending on the length of the growing season and tree age. The miners overwinter as prepupal larvae in cocoons in the soil. Infestations on ornamental trees can usually be controlled by banding, soil treatment or spraying with a systemic insecticide.

Discoloration and defoliation of white birch trees declined in the northern districts of the Region but continued to increase in the southern districts in 1984. In the Hearst District damage was generally light except for occasional pockets of moderate mining in cut-over areas in the southern part of the district. Severe browning was confined to ornamentals in the towns of Kapuskasing, Hornepayne, Cochrane and Iroquois Falls.

Table 1. Jack pine budworm - Summary of defoliation estimates and egg-mass counts on jack pine in 1984 and infestation forecasts for 1985.

Location (Twp)	Estimated % defoliation 1984	Total no. of egg masses on six 61-cm branch tips	Infestation forecasts for 1985[a]
Chapleau District (40 locations)			
Abney	5	0	N
Alcona - Stand 181	0	1	L
Birch	2	1	L
Blamey	39	10	H
Borden	1	0	N
Breadner	42	0	N
Carew	2	2	L
Cavana - Stand 194	0	0	N
Chappise - SPA[b]	0	2	L
Chewett	1	3	M
Cortez	29	0	N
Cunningham - Stand 449	1	2	L
Earl - Stand 199	0	10	H
Edighoffer - Stand 11	6	3	M
Eisenhower	9	7	H
Fawn	3	1	L
Fulton - Stand 282	3	6	H
Gladwin	3	3	M
Guindon - White Owl Lake	3	1	L
Hall Stand 302	2	7	H
Heenan - Stand 310	0	0	N
Iris	13	2	L
Ivanhoe	0	0	N
Ivy	24	8	H
Joffre - Stand 153	0	2	L
Kaplan - Hwy 667	5	15	H
Kaplan - Sultan	25	24	H
Keith	0	0	N
Kelso	14	1	L
Mallard - Stand 337	0	4	M
Margaret	3	3	M
McPhail - Stand 22	10	2	L
Neelands	37	22	H
Nimitz	3	0	N
Peters - Shoals Prov. Pk			
Reeves	0	0	N
Sandy	0	1	L
Shipley	69	11	H
Silk	0	0	N
Specht - Stand 227	5	1	L

(continued)

Table 1. Jack pine budworm - Summary of defoliation estimates and egg-mass counts on jack pine in 1984 and infestation forecasts for 1985 (continued).

Location (Twp)	Estimated % defoliation 1984	Total no. of egg masses on six 61-cm branch tips	Infestation forecasts for 1985[a]
Cochrane District (5 locations)			
Avon	0	0	N
Calvert	0	0	N
Dempsay	0	1	L
Dundonald	0	0	N
Sheldon	0	0	N
Gogama District (20 locations)			
Battersby - Stand 48	7	34	H
Cotton	22	3	M
Dublin	13	1	L
Garvey	76	36	H
Hazen	0	0	N
Invergarry	6	3	M
Kelvin	1	1	L
Lampman	27	3	M
Macmurchy	1	10	H
Mattagami	14	12	H
McNamara - Stand 129	1	4	M
Miramichi	32	16	H
Noble	9	3	M
Ogilvie	10	2	L
Onaping	14	2	L
Paudash - Stand 436	2	2	L
Roblin	0	0	N
Scotia	19	1	L
Vrooman	64	35	H
Westbrook	48	11	H
Hearst District (5 locations)			
Arnott	0	0	N
Beaton	0	0	N
Franz	0	0	N
Frost	0	0	N
Gill	0	0	N

(continued)

Table 1. Jack pine budworm - Summary of defoliation estimates and egg-mass counts on jack pine in 1984 and infestation forecasts for 1985 (concluded).

Location (Twp)	Estimated % defoliation 1984	Total no. of egg masses on six 61-cm branch tips	Infestation forecasts for 1985[a]
Kapuskasing District (5 locations)			
Fauquier	0	1	L
Harmon	0	0	N
Howells	0	0	N
Lisgar	0	0	N
Radisson	0	0	N
Kirkland Lake District (14 locations)			
Bannockburn	0	0	N
Charters	44	42	H
Corkill	64	25	H
Dunmore	2	0	N
Farr	15	1	L
Grenfell	0	0	N
James	5	0	N
McCann	0	0	N
McCool	8	0	N
Mickle	29	1	L
Mickle - Silver Claim Lake	6	21	H
Ray - East	12	8	H
Ray - West	32	16	H
Willet	11	5	M
Timmins District (5 locations)			
German	15	0	N
McKeown	2	0	N
Murphy	2	0	N
Robb	10	0	N
Sewell	0	0	N

[a] N = nil, L = light, M = moderate, H = heavy

[b] SPA = seed production area

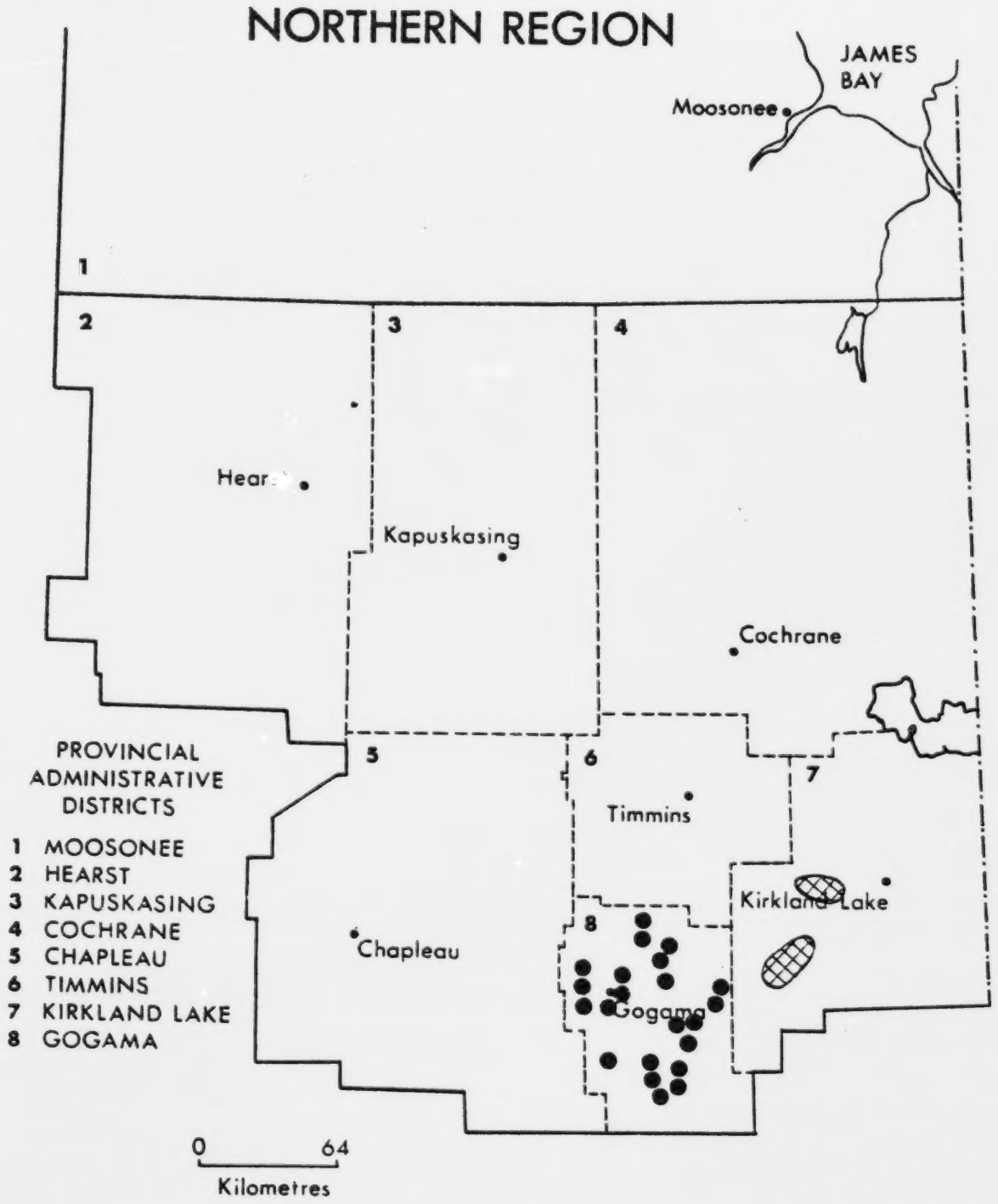


Figure 2. Birch Skeletonizer, *Bucculatrix canadensisella* Cham.

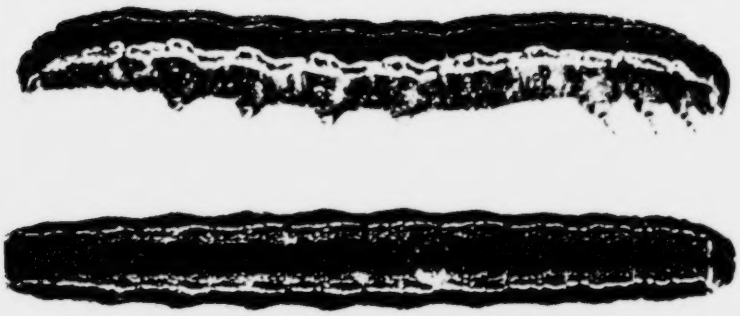
Areas in which defoliation of white birch (*Betula papyrifera* Marsh.) occurred in 1984

Moderate-to-severe . . . or ●

Table 2. Summary of leader damage caused by the eastern pine shoot borer in five districts in the Northern Region in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Leaders killed (%)
Chapleau District				
Edith	2.3	2,990	35	3
Peters	3.4	2,500	60	1
Dalmas	2.6	2,990	10	5
Silk	1.4	750	20	4
Bliss	2.5	2,775	75	5
Gilliland[a]	2.5	2,424	60	8
Gogama District				
Invergarry	3.3	2,550	55	3
Jack	2.2	3,000	60	2
Cochrane District				
Case	2.1	2,800	25	0
S. of Berry	2.9	2,000	25	5
Timmins District				
Adams	2.1	2,500	10	11
Thorneloe	3.0	2,500	10	8
Kirkland Lake District				
Catharine	2.6	2,400	15	13
Dunmore	2.8	2,500	50	11
Arnold	2.5	2,500	15	7
Cane	3.0	2,500	50	14

[a] 300-tree sample



Lateral view (top) and dorsal view (bottom) of the black army cutworm, *Actebia fennica* (Tausch.)

A pine seedling defoliated by the black army cutworm

Forest tent caterpillar, *Malacosoma disstria* Hbn., massed on a white birch (*Betula papyrifera* Marsh.) trunk

Aerial view of severe defoliation (light areas) caused by the forest tent caterpillar

In Chapleau, Gogama, Timmins and Kirkland Lake districts increasing numbers of mature trees showed conspicuous discoloration, and damage was readily detected during aerial surveys. In McNaught Township, Chapleau District, severe defoliation of white birch trees occurred over an area of approximately 1,000 ha. Damage to ornamental trees continued to plague property owners in these districts. Most of the white birch in the village of Gowganda, Kirkland Lake District, has been killed by repeated severe defoliation over the last five years. Heavy damage was also recorded in the towns of Earlton, Swastika, Kirkland Lake, Chapleau, Larder Lake, Timmins and South Porcupine.

American Aspen Beetle, *Gonioctena americana* (Schaef.)

A marked decline in populations of this pest of trembling aspen (*Populus tremuloides* Michx.) was evident in all districts of the Region. Although widely distributed through regeneration stands in Chapleau and Gogama districts, actual defoliation was very light. The most severe damage was recorded in a 3-ha stand near the Chapleau Airport where defoliation approximated 15%. Low populations were also observed in Larkin and Arnott townships, Hearst District, and at several locations in the Timmins and Kirkland Lake districts.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Although not found in other districts of the Region, populations of the forest tent caterpillar on trembling aspen increased considerably in the Kirkland Lake District (Fig. 3). The Painkiller Lake infestation northeast of Matheson expanded from 4,100 ha in 1983 to approximately 6,400 ha in 1984 (see photo page). A new infestation, about 78,650 ha in size, was located north and west of Lake Timiskaming and extended into the Temagami District of the Northeastern Region. This infestation included all or part of five townships in the southeastern corner of the Kirkland Lake District and all or part of seven townships in the northeastern part of the Temagami District. A third infestation comprising approximately 160 ha of severe defoliation was mapped near the southeast shoreline of Firth Lake in Milner Township.

Egg-band counts made in the various infestations in the fall indicate that severe defoliation will recur in all areas in 1984 (Table 3).

Whitespotted Sawyer Beetle, *Monochamus scutellatus* (Say)

No extensive damage by adult sawyer beetle feeding was observed in any of the districts in the Region. A relatively small area of damage occurred at one location in McCann Township, Kirkland Lake District, where approximately 2 ha of jack pine trees were killed along the fringe of a recently harvested stand.

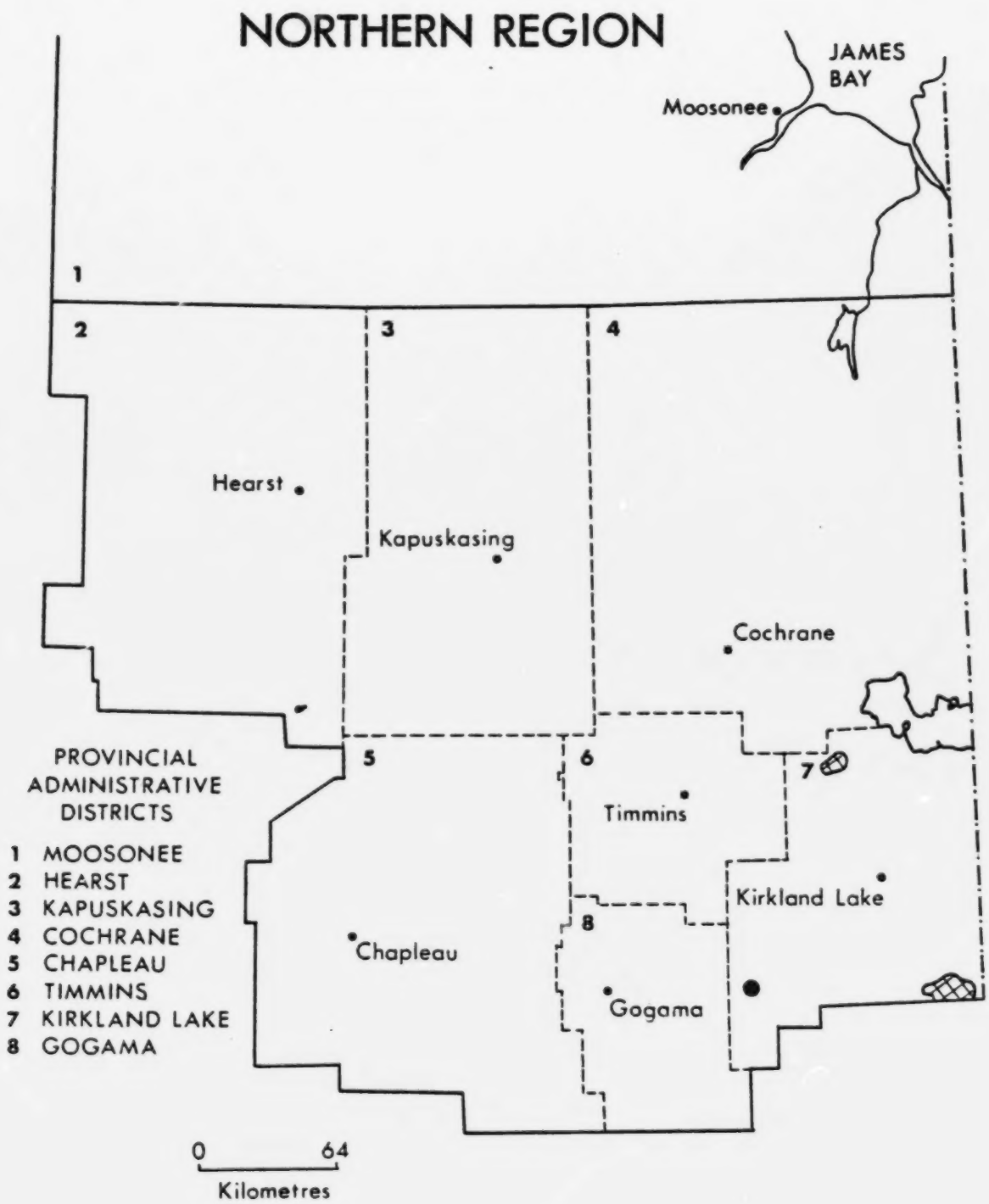


Figure 3. Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Areas within which moderate-to-severe defoliation occurred in 1984

or ●

Table 3. Summary of forest tent caterpillar egg-band counts on trembling aspen in the Kirkland Lake District in 1984 and infestation forecasts for 1985.

Location (Twp)	Avg DBH of trees (cm)	No. of trees sampled	Total no. of egg bands	Infestation forecasts for 1985
Carr	12.7	1	53	heavy
Coulson	5.0	1	13	"
Beatty	7.6	1	19	"
Harley	5.0	1	16	"
Henwood	12.7	3	9	light
Armstrong	7.6	1	32	heavy
Milner	12.7	1	41	"

Jack Pine Sawflies, *Neodiprion* spp.

Four species of *Neodiprion* sawfies were found infesting jack pine plantations and natural stands throughout the Region. In Hearst District, scattered colonies of *N. nanulus nanulus* Schedl. were present in Nagagamisis Provincial Park and at a roadside picnic site in McMillan Township. Mixed populations of *N. pratti banksianae* Roh. and *N. nanulus nanulus* caused approximately 5% defoliation of small groups of trees at several points along Highway 560 in Tyrrell and Milner townships in Kirkland Lake District. These two species were relatively abundant in the Gogama area, particularly in Noble Township where up to 35% of mature trees along the Minisinakwa River sustained defoliation ranging from 10 to 90%. Up to 60% defoliation was also recorded on ornamental jack pine trees near the OMNR Air Base, Gogama. In the Chapleau District, light defoliation occurred along the Biscotasing river in Carew Township and single trees at the OMNR Air Base in Chapleau were up to 80% defoliated. Moderate numbers of *N. maurus* Roh. caused about 10% defoliation of 2-m-high trees along 1 km of road in Gilliland Township. High numbers of the *N. virginianus* complex were also found at several locations in Chapleau District. In Gilliland Township 2-m-high jack pine trees were approximately 50% defoliated in an area of 0.5 ha; single trees were heavily defoliated in Shoals Provincial Park; and a 0.5-ha stand in Kaplan Township lost approximately 20% of its old foliage to this species.

Swaine Jack Pine Sawfly, *Neodiprion swainei* Midd.

The Swaine sawfly infestation in the Elk Lake Management Unit peaked in 1981 when an area of 5,699 ha of jack pine was moderately to severely defoliated in the Banks-Lady Evelyn lakes area. The following year the total area of moderate-to-severe defoliation declined to about

4,650 ha. In 1983 populations continued to decline and defoliation was relatively insignificant over most of the previously infested areas, except in two small pockets of medium infestation in the Banks-Alexander lakes area. In 1984, the downward trend continued to the point where it was not possible to detect any defoliation from the air. Colonies of the sawfly were present at most locations checked, but were at the lowest level observed since the outbreak commenced.

Aspen Leafblotch Miner, *Phyllonorycter ontario* (Free.)

A pronounced decline in populations of this leafminer was common to all districts of the Region. Heavily mined aspen foliage was extremely rare and in most cases only a few trees were affected at each location. Light mining was found at several points in all districts but foliar damage was generally insignificant in 1984.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

A definite increase in populations of this spruce sawfly was noted in most districts of the Region.

Severe defoliation of ornamentals, plantations and open-grown white spruce (*Picea glauca* [Moench] Voss) and black spruce trees was observed in the districts of Hearst, Kapuskasing and Cochrane. Ornamentals in the towns of Hearst, Kapuskasing, Smooth Rock Falls, Cochrane and Iroquois Falls were heavily defoliated. Sawflies were numerous at several points in Fushimi Provincial Park, Hearst District, at Rene Brunelle Provincial Park, at many summer cottages around Remi Lake, Kapuskasing District, and on Moose Factory Island, Moosonee District. In seven plantations examined, damage was generally light except in Calder Township, Cochrane District, where 85% of the trees were affected and defoliation averaged 29% (Table 4).

Moderate-to-severe defoliation of spruce in similar urban and forest situations was general through the Kirkland Lake and Timmins districts. Snow hedges along Highway 11 near Matheson were sprayed by the Ministry of Transportation and Communications and windbreaks at the Swastika Forest Station were treated by OMNR to control defoliation by the sawfly. Severe defoliation recurred in OMNR plantations in Stock Township, Timmins District, where approximately 280 ha of black spruce were heavily infested for the third consecutive year.

Ornamental white spruce trees with defoliation ranging from 10 to 80% were observed at Wakami Provincial Park in the Chapleau District near Ramsay; and on high-value trees at the OMNR nursery in Jack Township, Gogama District.

Table 4. Summary of yellowheaded spruce sawfly defoliation estimates in districts in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated no. of trees per ha	Trees affected (%)	Defoliation level (%)	Area affected (%)
Hearst District						
Larkin	wS	1.4	2,700	7.3	1	108
Cochrane District						
Clute	wS	1.2	2,100	51.0	1	25
Calder	wS	1.3	2,300	85.0	29	15
Fournier	bS	2.3	2,200	11.0	1	20
Kapuskasing District						
Fauquier	wS	4.1	2,400	3.3	1	12
Fauquier	wS	2.1	2,500	7.0	1	3

White Pine Weevil, *Pissodes strobi* (Peck)

Quantitative sampling showed no major change in leader mortality in pine and spruce plantations where sampling was carried out in 1983 (Table 5). The highest count recorded in 1984 was 19% in Willet Township, Kirkland Lake District. The insect kills the terminal, adversely affecting tree form.

Larch Sawfly, *Pristiphora erichsonii* (Htg.)

Little evidence of foliar damage by the larch sawfly has been detected in the Region since 1980 when approximately 5 ha of tamarack (*Larix laricina* (Du Roi) K. Koch in McCoig Township, Hearst District, were severely defoliated. In 1984 low populations were recorded in Hanlan Township, Hearst District; in Idington Township, Kapuskasing District; and in Langlois Township, Chapleau District, but in all instances defoliation was minimal.

Table 5. Summary of damage caused by the white pine weevil in seven districts in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated no. of trees per ha	Leaders attacked (%) 1983	Leaders attacked (%) 1984	Estimated area affected (ha)
Chapleau District						
Bliss[a]	jP	2.5	2,775	1	2	75
Edith	jP	2.3	2,990	5	5	35
Peters	jP	2.4	2,500	5	5	60
Gilliland[a]	jP	2.5	2,424	2	5	60
Dalmas	jP	2.6	2,990	21	7	10
Gogama District						
Invergarry	jP	3.6	2,550	6	4	55
Invergarry	jP	2.3	5,000	3	3	40
Jack	jP	2.7	3,000	1	3	60
Cochrane District						
Case	jP	2.1	2,800	0	1	25
Calder	wS	4.4	2,700	1	0	2
Fournier	bS	2.3	2,200	1	1	20
Kapuskasing District						
Fauquier	wS	2.1	2,500	-	2	3
Idington	wS	3.5	2,400	-	3	40
Hearst District						
Studholme	bS	3.1	2,100	1	1	25
Larkin	wS	1.4	2,700	-	1	108
Timmins District						
Adams	jP	2.1	2,500	7	11	10
Kirkland Lake District						
Catharine	jP	2.6	2,900	6	16	15
Arnold	jP	2.5	2,500	4	13	15
Cane	jP	3.0	2,500	-	9	50
Willet	jP	2.4	2,500	-	19	50

[a] 300-tree sample

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)

A pronounced decline in populations of this sawfly was common to all districts in the Region. Lightly defoliated mountain-ash (*Sorbus americana* Marsh.) trees were observed infrequently in forested stands and damage to ornamentals was unusually light in urban areas.

Spearmarked Black Moth, *Rheumaptera hastata* (L.)

Populations of this insect have declined steadily since 1982 when moderate-to-severe defoliation of white birch foliage occurred over an area of 4,081 km^2 in the Chapleau District. Pockets of trace-to-light defoliation persisted at several locations in Neelands, Daoust and Edith townships in 1984.

Table 6. Other forest insects.

Insect	Host(s)	Remarks
Acantholyda sp.	jP	found at one location in Chapleau Twp, Chapleau District
Aceria sp. nr. *dispar* (Nalepa) Aspen leaf mite	tA	conspicuously distorted foliage at many locations in Chapleau, Kirkland Lake and Timmins districts
Acleris logiana placidana Rob. Blackheaded birch leaffolder	wB	low numbers in most stands examined in Chapleau and Gogama districts
Acleris variana Fern. Eastern blackheaded budworm	wS	several larvae found in McEvay Twp, Kirkland Lake District and in several areas in the Hearst, Kapuskasing and Cochrane districts
Acrobasis betulella Hlst. Birch tubemaker	wB	lightly defoliated trees common throughout Chapleau, Cochrane, Kirkland Lake and Timmins districts
Adelges abietis (L.) Eastern spruce gall adelgid	wS	several trees heavily infested in a plantation in McEvay Twp, Kirkland Lake District

(continued)

Table 6. Other forest insects (continued).

Insect	Host(s)	Remarks
Altica ambiens alni Harr. Alder flea beetle	Al	heavily defoliated shrubs at many locations in Chapleau, Cochrane, Kirkland Lake and Timmins districts
Anchylopera nubeculana Clem. Cherry leaffolder	pCh	low numbers common throughout Gogama District
Archips cerasivorana (Fitch) Uglynest caterpillar	eCh pCh	nests common, particularly in rural areas in Cochrane and Kirkland Lake districts
Arge spp.	Al	low numbers on shoreline trees around Pierre Lake, Cochrane District
Argyresthia laricella Kft. Larch shoot moth	tL	caused branch flagging at several locations in Caouette and Langlois twps, Chapleau District
Cephalcia spp.	jP	occasional nests on regeneration trees in Sheldon Twp, Cochrane District and in Cross Twp, Hearst District
Choristoneura rosaceana (Harr.) Obliquebanded leaf roller	tA wB	leaf rolls common in Kirkland Lake and Timmins districts
Chrysomela walshi Brown Balsam poplar leaf beetle	bPo	common in Kirkland Lake and Timmins districts but defoliation not as severe as in 1983
Coleophora laricella (Hbn.) Larch casebearer	tL	low numbers at check point in Calder Twp, Cochrane District
Conophthorus banksianae McPherson Jack pine tip beetle	jP	conspicuous damage to branch tips common in all districts in the Region
Corythuca sp. prob. *elegans* Drake Willow lace bug	W	severe defoliation at numerous locations along Hwy 101 west of Chapleau, Chapleau District

(continued)

Table 6. Other forest insects (continued).

Insect	Host(s)	Remarks
Datana ministra (Dru.) Yellownecked caterpillar	wB	light defoliation of several trees in Iroquois Falls, Cochrane District and in the Earlton-New Liskeard area, Kirkland Lake District
Dimorphopteryx melanognathus Roh. Fringed birch sawfly	wB	several trees lightly damaged in Shoals Prov. Pk, Chapleau District
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	wS	low populations reported from Cochrane, Hearst, Kapuskasing and Kirkland Lake districts
Epinotia solandriana L. Birch-aspen leafroller	wB	found commonly at low levels through Chapleau, Kirkland Lake and Timmins districts
Eriophyes negundi Hodgk. Manitoba maple gall mite	mM	high numbers in the town of Kapuskasing
Eupareophora parca (Cress.) Spiny ash sawfly	bAs	upper third of tree crowns lightly defoliated in many stands in Kirkland Lake and Timmins districts
Fenusa dohrnii (Tischb.) European alder leafminer	Al	severe browning of foliage along Hwy 144, Mattagami Twp, Gogama District
Gilpinia hercyniae (Htg.) European spruce sawfly	wS	low numbers of larvae at several points in Chapleau, Kirkland Lake and Timmins districts
Gracillaria invariabilis Braun. Cherry leafcone caterpillar	pCh,ecCh	very common on this host throughout Chapleau District
Hylemya anthracina (Czerny) Spruce cone maggot	wS	moderate cone damage in the Nimitz Twp seed production area, Chapleau District
Hyles gallii (Rott.) Bedstraw sphinx	herbaceous plants	unusually common throughout the Region

(continued)

Table 6. Other forest insects (continued).

Insect	Host(s)	Remarks
Hylobius sp., prob. *warreni* Wood	jP	two trees girdled in Bliss Twp, Chapleau District
Hyphantria cunea (Dru.) Fall webworm	deciduous	very common in Kirkland Lake and Timmins districts
Malacosoma californicum pluviale Dyar Northern tent caterpillar	pCh,wB	tents common along roads and in cutover areas in Chapleau, Cochrane, Kirkland Lake and Timmins districts
Mecas inornata Say Poplar gall borer	tA	regeneration heavily infested at one point in Dublin Twp, Gogama District
Meroptera pravella Grt. Lesser aspen webworm	tA	low numbers found throughout Chapleau and Gogama districts
Micrurapteryx salicifoliella Cham. Willow leafminer	W	severe defoliation along roads north and south of Hwy 11 in the western part of Hearst District
Nematus limbatus Cress. Willow sawfly	W	common throughout the Chapleau District
Nematus salicisodoratus Dyar Willow sawfly	W	low populations in Fauquier Twp, Kapuskasing District
Neodiprion abietis complex Balsam fir sawfly	bF	light defoliation in Manning Twp, Chapleau District; Clute Twp, Cochrane District and Larkin Twp, Hearst District
Neurotoma inconspicua (Nort.) Plum webspinning sawfly	pCh	single colonies in Gallagher Twp and in Ivanhoe Prov. Pk, Chapleau District
Nymphalis antiopa (L.) Mourningcloak butterfly	deciduous	defoliated shrubs and trees observed throughout the Region with increased numbers noted in the Hearst, Cochrane and Kapuskasing districts

(continued)

Table 6. Other forest insects (continued).

Insect	Host(s)	Remarks
Oligonychus ununguis (Jac.) Spruce spider mite	tL	severe browning, up to 50% of foliage affected, in Fauquier Twp, Kapuskasing District and in Casgrain Twp, Hearst District
Paraprociphilus tessellatus (Fitch) Woolly alder aphid	Al	low populations in Bonis Twp, Cochrane District
Petrova albicapitana (Busck.) Northern pitch twig moth	jP	widely distributed through Chapleau, Kirkland Lake and Timmins districts but caused little damage
Phratora purpurea purpurea Brown Aspen skeletonizer	tA	low numbers at several points in Frost Twp, Hearst District
Phyllonorycter kenora (Free.) Willow leafblotch miner	W	occasional light defoliation along roads in Chapleau District
Phyllonorycter nipigon (Free.) Balsam poplar leafblotch miner	bPo	severe mining in Newmarket and St. John twps, Cochrane District
Physokermes piceae (Schr.) Spruce bud scale	wS	low numbers in Clute Twp, Cochrane District
Pleroneura brunneicornis Roh. Balsam shootboring sawfly	bF	heavily infested trees at several points in Lamplugh and Harker twps, Kirkland Lake District
Pristiphora lena Kinc. Little spruce sawfly	spruce	light defoliation of single trees in Manning Twp, Chapleau District; in Clute Twp, Cochrane District and in Fauquier Twp, Kapuskasing District
Pseudaletia unipuncta (Haw.) Armyworm	herbaceous plants	numerous within the towns of Hearst, Hornepayne and Kapuskasing

(continued)

Table 6. Other forest insects (concluded).

Insect	Host(s)	Remarks
Pulicalvaria piceaella (Kft.) Orange spruce needleminer	bF	a few larvae at several points in McFadden Twp, Kirkland Lake District
Pyrrhalta sp. prob. *decora decora* (Say) Gray willow leaf beetle	W	severe defoliation along roads and in old fields in Chapleau, Gogama and Kirkland Lake districts
Semiothisa sp. prob. *oweni* (Swett) Larch looper	tL	low numbers on roadside trees along Hwy 129 south of Chapleau
Tetralopha aplastella (Hlst.) Aspen webworm	tA	low numbers observed in Gallagher Twp, Chapleau District and Bragg Twp, Cochrane District
Toumeyella parvicornis (Ckll.) Pine tortoise scale	jP	single and small groups of trees heavily infested at several locations in Chapleau, Kirkland Lake and Timmins districts
Vasates quadripes (Shim.) Maple bladdergall mite	siM	high numbers on ornamentals in the town of Iroquois Falls, Cochrane District
Zeiraphera sp.	wS	light damage in Clute Twp, Cochrane District
Zelleria haimbachi Busck Pine needle sheathminer	jP	higher than usual numbers observed in Chapleau, Gogama, Kirkland Lake and Timmins districts

TREE DISEASES

Major Diseases

Armillaria Root Rot, *Armillaria mellea* (Vahl : Fr.) Kummer

Armillaria root rot evaluations were conducted in twenty areas but the presence of the disease was detected at only six locations (Table 7). Mortality was less than 0.7% in all areas examined. Often light infections may be present at levels too low to be detected on the randomly selected plots. Of the six areas found to be affected, five were 300-tree samples instead of the usual 150 trees, which suggests that the larger samples may be more representative.

Although the disease does attack a variety of natural and planted species, only white spruce and jack pine were examined in the present survey. Plantations are especially susceptible to attack by the pathogen because the trees are growing under unnatural conditions.

Table 7. Summary of mortality caused by Armillaria root rot in four districts in the Northern Region in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Current mortality (%)
Chapleau District					
Bliss[a]	jP	1.9	2,424	60	.3
Gilliland[a]	jP	2.5	2,775	75	.3
Hearst District					
Cross[a]	jP	1.5	2,541	220	.3
Larkin	wS	1.4	2,700	108	.7
Kirkland Lake District					
Corkill[a]	jP	3.3	2,900	322	.3
Timmins District					
Robb[a]	jP	1.7	2,900	50	.3

[a] 300-tree sample

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schw.) d By. var. *ledi* and *C. ledicola* Lagh.

A conspicuous increase in foliar damage by this needle rust disease was noted in most stands in the Region. Infections varied from light to heavy and all age and crown classes were affected. Requests for identification and control of the disease on ornamentals were received from many property owners in built-up areas across the Region.

The degree of damage appears to be a function of weather and the presence of the alternate hosts, leatherleaf *(Chamaedaphne calyculata* [L.] Moench) and Labrador tea *(Ledum groenlandicum* Oeder). Heavy infections can result in severe defoliation which causes a reduction in growth.

The needle infection was observed in several of the spruce plantations examined as part of the special survey of white spruce, and in surveys for the presence of other pests (Table 8). The percentage of trees affected was high, with an average of 72%, but damage was generally light. This was not the case in all areas, however. A damage assessment was instituted in a natural stand in each of Burt and Flavelle townships, Kirkland Lake District where 100% and 80% of the current foliage was affected, respectively. Many other natural stands were observed throughout the Region, as far north as Moosonee, with widespread heavy foliar damage.

Ink Spot of Aspen, *Ciborinia whetzelii* (Seav.) Seav.

An increase in the incidence of this foliage disease was observed across the Region. Defoliation levels varied, with severe damage sporadic and confined mainly to small pockets of less than 10 ha. Severe infections resulted in leaf necrosis, browning and premature leaf drop (see photo page).

Pockets of heavy damage were widespread and common in most stands in the districts of Kirkland Lake, Timmins, Gogama, Cochrane and Chapleau. Low infections with the occasional small area of moderate damage were observed in the Kapuskasing and Hearst districts.

Areas that were evaluated revealed a high incidence of infection, 50-100%, with an average defoliation level of 68% (Table 9).

Table 8. Summary of damage caused by spruce needle rust in six districts in the Northern Region in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Defoliation level (%)
Chapleau District						
Lloyd	wS	4.5	1,000	22	40	<1
Manning	wS	3.1	2,442	32	75	3
Cochrane District						
Colder	wS	4.4	2,700	2	96	<1
Clute	wS	1.2	2,100	25	100	<1
Fournier	bS	2.3	2,200	20	100	1
Gogama District						
Garibaldi	wS	.9	2,300	22	17	<1
Hearst District						
Larkin	wS	1.4	2,700	108	99	1
Kapuskasing District						
Fauquier	wS	2.1	2,500	3	85	1
Idington						
Kirkland Lake District						
Burt[a]	bS	3.0	1,500	5	100	100
Flavelle[a]	bS	5.0	800	5	100	80
McEvoy	wS	3.8	2,990	10	1	<1

[a] Natural stands

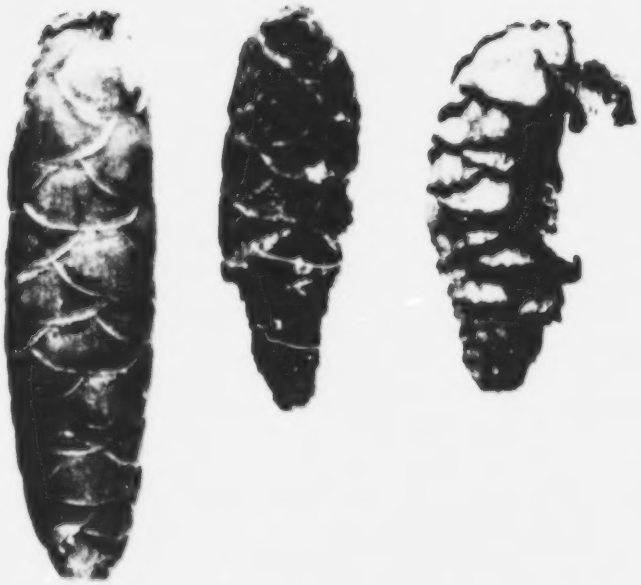
Table 9. Summary of ink spot of aspen evaluations in three districts in the Northern Region in 1984 (counts based on the examination of 100 or 150 randomly selected trees at each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Defoliation level (%)
Chapleau District						
Deans	tA	15	2,800	10	50	50
Mageau	tA	10	2,400	10	60	60
Kirkland Lake District						
Benoit	tA	3	5,000	3	100	50
Grenfell	tA	4	5,000	2	100	75
Harker	tA	4	5,000	3	100	75
McEvay	tA	4	5,000	5	100	80
Otto	tA	4	5,000	3	100	70
Milner	tA	5	5,000	4	100	75
Lawson	tA	6	5,000	5	100	75
Farr	tA	7	5,000	5	100	75
Timmins District						
Hassard	tA	7	5,000	5	100	75
McKeown	tA	6	5,000	2	100	75
Matheson	tA	6	5,000	10	100	50

Ink spot of aspen, *Ciborinia whetzellii* (Seav.) Seav., on trembling aspen (*Populus tremuloides* Michx.) leaf showing symptomatic necrosis and black spots

A severe Hypoxylon canker, *Hypoxylon mammatum* (Wahl.) J.H. Miller, has weakened this trembling aspen tree, causing the top to break.

White spruce (*Picea glauca* [Moench] Voss) with male (left), and female (right) flowers



White spruce cones: healthy (left), and damaged by insect feeding (middle, right)

Root rot damage evident in a black spruce (*Picea mariana* [Mill.] B.S.P.) forest

Pine Needle Rust, *Coleosporium asterum* (Diet.) Syd.

Since 1974 damage by this foliar disease has been light or absent in most areas of regeneration in the Region. However, chronic problems have occurred in the past in the Hearst and Cochrane districts.

From 1974 to 1977 moderate-to-severe infections occurred in Avon Township, Cochrane District and Studholme Township, Hearst District. Since 1981, moderate levels of infection have been recorded in a plantation in Arnott Township, Hearst District. An evaluation in 1984 disclosed that 100% of trees in this area were affected with an average infection rate in the older foliage of 43%. These figures were similar to those of the previous year. Although foliar damage has been high, mortality has been nil. Heavy fruiting of this pathogen can probably cause some reduction in growth of sapling trees.

The alternate hosts for this disease are goldenrod (*Solidago* sp.) and aster (*Aster* sp.).

Sweetfern Blister Rust, *Cronartium comptoniae* Arth.

This disease occurs only where either of the two alternate hosts, sweetfern (*Comptonia peregina* [L.] Coult.) or sweet gale (*Myrica gale* L.) are found. This stem infection can kill sapling-size trees, and over a period of time causes the development of stem cankers on larger trees which often result in basal defect.

The percentage of trees affected in five areas where the disease was observed ranged from 1% in Bliss Township, Chapleau District to 28% in an area near Nellie Lake in Calvert Township, Cochrane District (Table 10). An average of 12% of trees was affected at the five locations.

Table 10. Summary of damage caused by sweetfern blister rust in three districts in the Northern Region in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)
Chapleau District					
Neelands	jP	15.0	2,000	10	24
Bliss[a]	jP	2.0	2,775	60	1
Cochrane District					
Calvert	jP	17.0	2,500	10	28
Dundonald	jP	3.8	4,300	25	4
Timmins District					
Robb	jP	1.2	2,990	50	3

[a] 300-tree sample

Hypoxylon Canker, *Hypoxylon mammatum* (Wahl.) J.H. Miller

A special survey was conducted in 1984 to assess the impact of Hypoxylon canker in trembling aspen stands in four districts in the Region (Fig. 4). Twenty plots were established in the Cochrane, Gogama, Kapuskasing and Hearst districts (Table 11). Trees in four plots were marked for re-examination. Study plots were established in 1983 and 1984 in the Chapleau and Kirkland Lake districts, and results of surveys conducted there will be published at a later date.

The trees were examined for the presence of branch or stem cankers, and current mortality was recorded. Stem cankers are obviously a more serious threat to the tree than branch cankers. The canker may girdle the tree causing the area distal to the canker to die, or weaken the tree at the point of infection, making it prone to wind breakage (see photo page).

A higher incidence of diseased trees was noted in the Gogama District where an average of 3% of the trees examined had stem infections. Four of the ten plots examined in the Cochrane, Hearst and Kapuskasing districts were found to have one or two trees with stem cankers, while on the other plots no evidence of the disease was encountered.

Minor Diseases

Leaf Spot, *Mycosphaerella populicola* G.E. Thomps.

Severe browning and premature leaf drop in many stands of balsam poplar (*Populus balsamifera* L.) were noted throughout the Northern Region. All age classes from roadside regeneration to mature trees were affected.

The infections consist of spots which vary in size and often are joined, covering half of the leaf surface. These lesions reduce the photosynthetic area of the leaf, resulting in a growth reduction.

Shoot Blight, *Venturia macularis* (Fr.) Müller & Arx
(= *Pollaccia radiosa* [Lib.] Bald. & Cif.)

This disease attacks the leaves and shoots of the current year's growth of juvenile poplar trees. Repeated attacks affect tree form and cause growth loss.

Damage levels of this shoot disease, typified by black curled leaves and shoots, varied within the Region (Table 12).

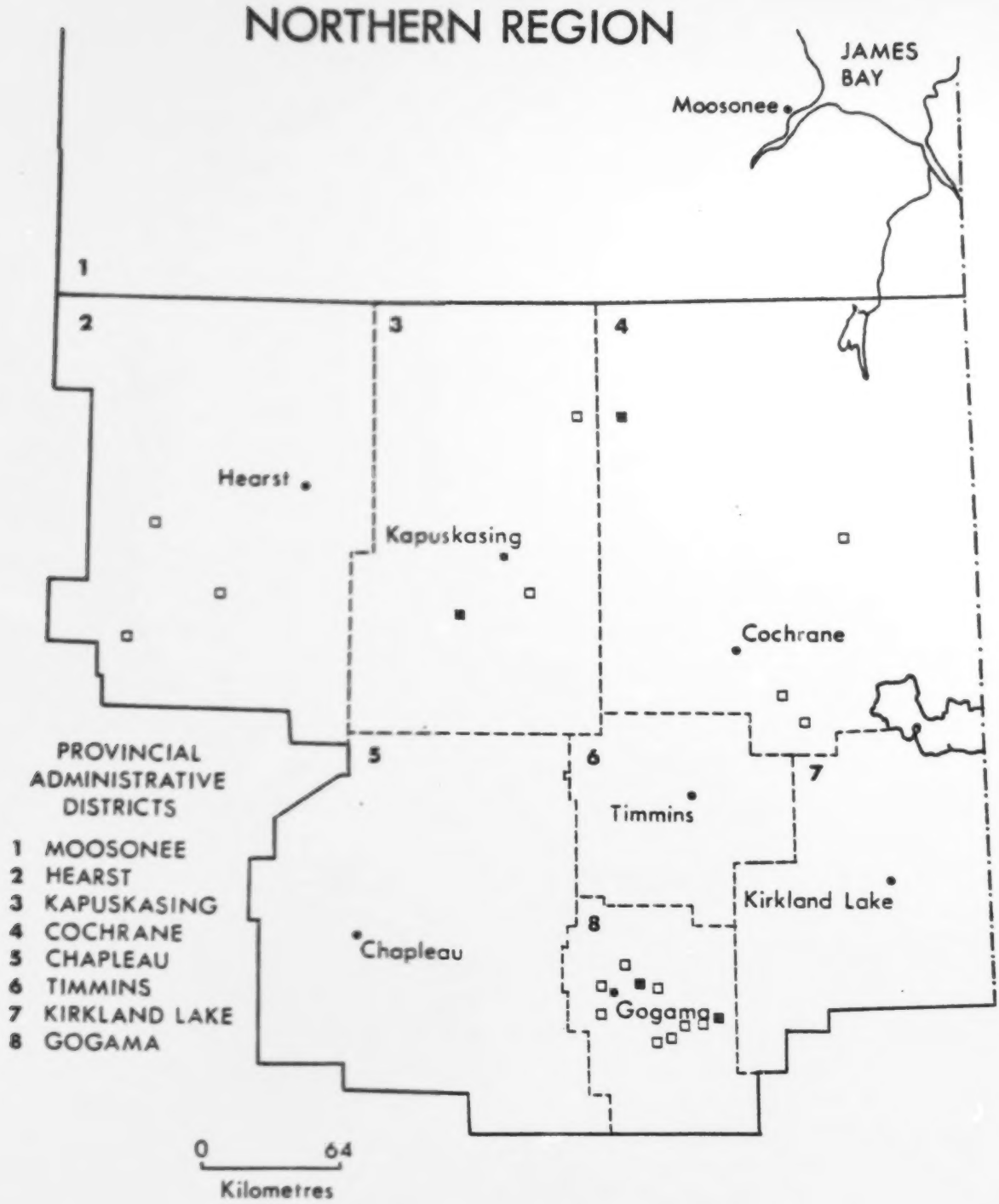


Figure 4. Hypoxylon Canker, *Hypoxylon mammatum* (Wahl.) J.H. Miller

Areas surveyed in 1984 . . . . . □

Study plots established in 1984 . . . ■

Table 11. Summary of damage caused by Hypoxylon canker of aspen in four districts in the Northern Region in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg DBH of trees (cm)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees diseased		Current mortality (%)
				branch (%)	stem (%)	
Gogama District						
Asquith	16.8	1,000	28	0	0	0
Garvey	14.8	1,000	34	0	0	0
Jack	17.6	1,800	10	.7	.7	0
Macmurchy	29.8	2,100	11	2.0	1.3	0
Macmurchy[a]	19.2	1,800	30	.7	.7	0
Macmurchy	12.7	1,600	4	.7	8.7	1.3
Noble[a]	16.1	1,200	12	0	2.0	0
Noble	12.1	1,000	12	.7	5.3	0
Noble	17.0	1,800	9	1.3	8.0	.7
Noble	17.7	1,200	44	1.3	3.3	0
Cochrane District						
Aurora	14.5	2,200	50	0	1.3	0
Sheldon[a]	31.3	900	25	0	0	0
Teefy	21.9	2,100	50	0	0	0
Tweed	25.6	2,200	25	0	0	0
Hearst District						
Alderson	25.6	1,100	25	0	0	0
Larkin	25.4	1,100	50	0	.7	0
McEwing	37.6	850	50	0	.7	0
Kapuskasing District						
Howells	29.9	1,100	50	0	0	0
Hansen	27.8	800	50	0	0	0
Shanly[a]	29.6	1,000	25	0	.7	0

[a] Study plot to be re-examined in 1986.

Table 12. Summary of damage caused by shoot blight to aspen in seven districts in the Northern Region (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Leader mortality (%)
Chapleau District					
Kaplan	2.0	6,500	20	55	3
Gallagher	1.8	3,500	15	60	17
Cochrane District					
Bragg	1.6	18,000	50	97	90
Sheldon	3.1	12,000	50	95	80
Cogama District					
Jack	1.5	8,000	20	58	10
Hearst District					
Alderson	2.3	18,000	10	93	78
Kapuskasing District					
Fauquier	2.7	10,000	10	98	87
Kirkland Lake District					
Grenfell	2.0	6,000	2	60	10
McEvoy	2.0	6,000	3	40	5
Nordica	3.0	7,000	2	40	6
Lawson	3.0	7,000	5	20	8
Farr	2.0	6,000	1	30	5
Timmins District					
Hassard	3.0	5,000	1	30	5
Thorneloe	3.0	5,000	1	50	10

The number of infections was much higher in the northern part of the Region, in Cochrane, Kapuskasing and Hearst districts. The percentage of trees affected in four areas examined averaged 96%. Leader infections were correspondingly high, with 84% of examined trees having diseased leaders. The previous year 33% of the trees examined were affected, with only 7% of the leaders diseased.

The number of infected trees decreased in 1984 in Kirkland Lake and Timmins districts. The average percentage of trees affected in seven areas examined was 39%, a 17% decrease from the previous year. Leader damage was low, ranging from 5% to 10%.

Three areas were examined in the Gogama and Chapleau districts and the percentage of trees affected averaged 58%. Leader injury was low.

Table 13. Other forest diseases.

Organism	Host(s)	Remarks
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	no extension in range found in 1984
Chrysomyxa pirolata Wint. Spruce cone rust	spruce	light damage reported from Studholme and Hanlan twps, Hearst District and Calder Twp, Cochrane District
Cronartium comandrae Pk. Comandra blister rust	jP	single canker in OMNR Tree Improvement Area in Dalmas Twp, Chapleau District
Endocronartium harknessii (J.P. Moore) Y. Hirat. Western gall rust	jP	light infection levels throughout Region; high numbers of galled trees at Wakami Lake Prov. Pk, Chapleau District
Erwinia amylovora (Burr.) Winsl. et al. Fire blight	Mo	severe infections of ornamentals in the town of Cochrane; light-to-moderate damage in town of Kapuskasing
Leucostoma persoonii (Nitschke) Höhn. Cytospora canker	Mo	severe cankers on numerous ornamentals through town of Chapleau

(continued)

Table 13. Other forest diseases (concluded).

Organism	Host(s)	Remarks
Linospora tetraspora G.E. Thomps. Leaf blight	bPo	high foliar infections on regeneration trees in Mortimer and St. John twps, Cochrane District, and in Ivanhoe, Barclay and Gallagher twps, Chapleau District
Lophodermium seditiosum Minter et al. Needle cast	rP	30% foliar damage to 18 trees in Lloyd Twp, Chapleau District
Lophodermium sp. Needle cast	wP	approximately 40% foliar damage to 20 trees in Lloyd Twp, Chapleau District
Melampsorella caryophyllacearum Schroet. Fir broom rust	bF	light damage in Greenwater Prov. Pk, Cochrane District and in Fushimi Prov. Pk, Hearst District
Mycosphaerella populicola G.E. Thomps. Leaf spot	wB	severe browning and premature leaf drop on occasional groups of trees in Heighington Twp, Cochrane District
Mycosphaerella populorum G.E. Thomps. Leaf spot	bPo	severe damage to regeneration trees in Stoddart Twp, Hearst District
Pucciniastrum epilobii Otth Fireweed rust	bF	light foliar damage in Fushimi Twp, Hearst District; moderate damage in Daoust and Gallagher twps, Chapleau District
Rhytisma punctatum (Pers.) Fr. Speckled tar spot	mM	common at many points in Asquith Twp, Gogama District
Rhytisma salicinum (Pers.) Fr. Tar spot	W	moderate levels of foliar damage encountered in Noble Twp, Gogama District

SPECIAL SURVEYS

White Spruce Plantations

In 1984, a special survey was conducted to assess the impact of insect and disease problems in white spruce plantations or high-value stands (Fig. 5) in the Northern Region (Table 14). Stand selection was based on three height classes: under 2 m, 2-6 m and over 6 m. A random sampling procedure was used, and 150 trees per stand were examined in two visits during the periods 10-30 June and 15-31 July. The stands were evaluated for the presence of the following selected insects, diseases and abiotic damage:

Insects: spruce budworm, spruce coneworm, yellowheaded spruce sawfly, white pine weevil and spruce shootworms

Diseases: Armillaria root rot, spruce needle rust, spruce cone rust, spruce broom rust (*Chrysomyxa arctostaphyli* Diet.), and dwarf mistletoe (*Arceuthobium pusillum* Pk.)

Abiotic Damage: frost

All insects, and all diseases except spruce broom rust and dwarf mistletoe, were found in at least one area of evaluation. Positive results are summarized in Table 14.

Miscellaneous insects and diseases not specifically designated as part of the survey were also evaluated, but none was responsible for appreciable damage. They include:

Eastern blackheaded budworm
Eastern spruce gall adelgid
Spruce gall adelgid - *Adelges lariciatus* (Patch)
Balsam fir sawfly
Spruce bud scale
Ragged spruce gall adelgid - *Pineus similis* (Gill.)
Greenheaded spruce sawfly - *Pikonema dimmockii* (Cress.)
Little spruce sawfly

The special survey of white spruce revealed that, except for one area of spruce budworm damage in the Hearst District, no serious pest problem existed in any of the areas surveyed.

The average number of trees attacked by spruce budworm in the 13 areas examined was 31%. Except for a Seed Production Area (SPA) in Hanlan Township, Hearst District, where defoliation rates were much greater, average defoliation ranged from < 1% to 1.8% (see Table 14). A tree was considered attacked if only a single larva was observed. A previous survey of 12 areas in 1981 found 51% of examined trees affected, with an average defoliation rate of 9.5%.

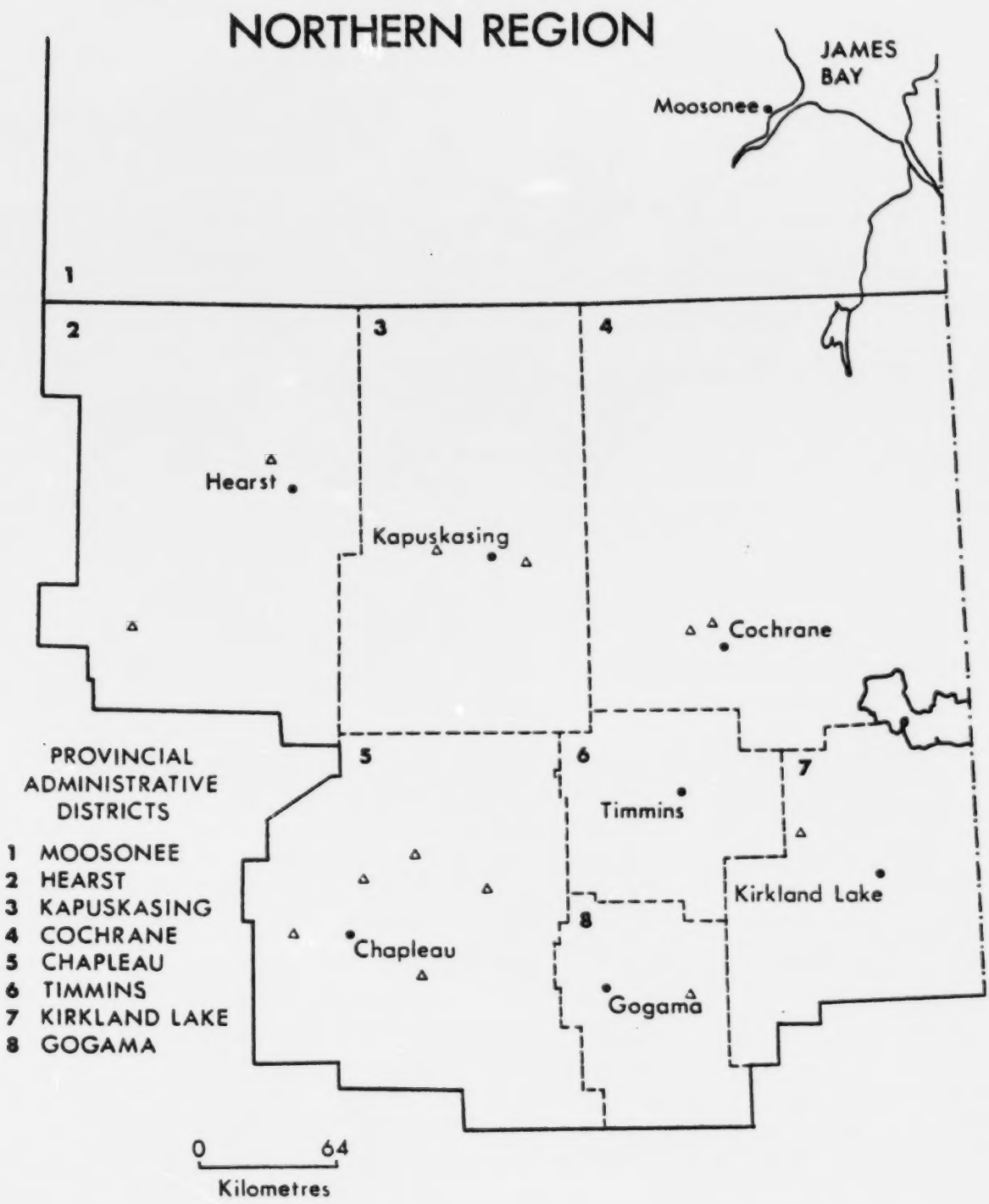


Figure 5. White spruce (*Picea glauca* [Moench] Voss) plantations surveyed in 1984 . . . . . Δ

Defoliation associated with yellowheaded spruce sawfly was light in the six areas where larvae were collected. An evaluation in a plantation in Calder Township, Cochrane District revealed 51.3% of the trees were affected but overall defoliation was < 1%.

Leaders damaged by white pine weevil were recorded in four plantations. In two areas 2.7% of the trees were infested.

Low numbers of spruce coneworm, and correspondingly light defoliation, were detected in eight areas. The feeding habits and damage caused by this pest are similar to those of the spruce budworm.

Evaluations disclosed up to 50% of the trees examined to be affected by spruce shootworms, *Zeiraphera* spp., but accompanying damage was light. The larvae feed on the expanding new shoots.

A high incidence of trees infected by spruce needle rust was noted in six of seven areas where it was recorded. Damage was light in all cases.

Spruce cone rust was detected in an SPA in Hanlan Township, Hearst District. One hundred cones were examined and 3% were found to be infected.

Armillaria root rot was found in one plantation in Larkin Township, Hearst District.

Frost damage was minimal in the current survey.

White Spruce Seed, Cone and Flower Pests

As part of the special survey of white spruce, a collection of female flowers was taken from three locations in the Region (see photo page). The flowers were taken from a minimum of three trees at the late flowering stage after pollination but before they become fleshy and turned over as a conelet. Later approximately 100 current cones were removed from the same trees (see photo page). Cones were also sampled at three different locations. The cone samples are taken at the time they are picked for seed extraction. Samples were sent to the Great Lakes Forest Research Centre for dissection and analysis, which revealed the presence of the following insect pests:

Table 14. Summary of the results of a special survey of 13 white spruce plantations or high-value stands in the Northern Region in 1984 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Ht class (m)	Spruce budworm		Yellowheaded spruce sawfly		White pine weevil	Spruce coneworm		Spruce shootworms
				Trees attacked (%)	Defoliation (%)	Trees attacked (%)	Defoliation (%)	Trees affected (%)	Trees attacked (%)	Defoliation (%)	Trees attacked (%)
Chapleau District											
Gilliland	40	1,500	0.5-2.0	11.3	<1	1.7	<1	0	.7	<1	14.0
Lloyd	22	1,000	2.1-6.0	50.0	1.5	.7	<1	0	3.3	<1	0
Manning	32	2,442	2.1-6.0	28.0	1.8	10.0	<1	0	0	0	4.0
Nimitz	10	1,000	>6.0	64.0	<1	0	0	0	6.4	<1	0
Reeves	10	1,000	>6.0	22.0	<1	0	0	0	0		0
Gogama District											
Garibaldi	22	2,330	0.5-2.0	3.3	<1	0	0	0	0	0	20.0
Kirkland Lake District											
McEvay	10	2,990	2.1-6.0	1.3	<1	0	0	2.7	0	0	4.0
Cochrane District											
Clute	6	1,200	>6.0	20.0	<1	0	0	0	20.0	<1	50.0
Clute	25	2,000	0.5-2.0	2.0	<1	51.3	<1	.7	4.0	<1	22.6
Hearst District											
Hanlan	45	1,000	>6.0	100	87	0	0	0	0	0	0
Larkin	108	2,700	0.5-2.0	74.0	<1	7.3	<1	.7	1	<1	0
Kapuskasing District											
Fauquier	12	2,400	2.1-6.0	10.7	<1	3.3	<1	0	3.3	<1	58.7
Idington	40	2,400	2.1-6.0	15.3	<1	0	0	2.7	4.7	<1	0

(continued)

Table 14. Summary of the results of a special survey of 13 white spruce plantations or high-value stands in the Northern Region in 1984 (counts based on the examination of 150 randomly selected trees at each location) (concluded).

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Ht class (m)	Frost		Needle rust		Cone rust		Armillaria root rot
				Trees affected (%)	Foliage damaged (%)	Trees affected (%)	Foliage damaged (%)	Trees affected (%)	Cones damaged (%)	Trees affected (%)
Chapleau District										
Gilliland	40	1,500	0.5-2.0	3.3	<1	0	0	0	0	0
Lloyd	22	1,000	2.1-6.0	0	0	40.0	<1	0	0	0
Manning	32	2,442	2.1-6.0	20.7	1.2	75.3	2.9	0	0	0
Nimitz	10	1,000	>6.0	0	0	0	0	0	0	0
Reeves	10	1,000	>6.0	0	0	0	0	0	0	0
Cogama District										
Garibaldi	22	2,300	0.5-2.0	6.0	<1	17.3	<1	0	0	0
Kirkland Lake District										
McEvay	10	2,990	2.1-6.0	4.0	<1	.7	<1	0	0	0
Cochrane District										
Clute	5	1,200	>6.0	0	0	0	0	0	0	0
Clute	25	2,100	0.5-2.0	18.0	<1	100	<1	0	0	0
Hearst District										
Hanlan	45	1,000	>6.0	0	0	0	0	-[a]	3	0
Larkin	108	2,700	0.5-2.0	0	0	98.7	<1	0	0	.7
Kapuskasing District										
Fauquier	12	2,400	2.1-6.0	1.3	<1	96.7	<1	0	0	0
Idington	40	2,400	2.1-6.0	0	0	100	<1	0	0	0

[a] Due to tree size, trees affected could not be determined but 100 cones from 3 trees were examined

Spruce cone axis midge, *Dasineura rachiphaga* Tripp - The seeds are not attacked directly by the larvae but the connective tissue is damaged, which interrupts the nutrient supply to the developing seeds.

Spruce cone maggot, *Hylemya anthracina* (Czerny) - Once hatched, the larvae tunnel spirally around the cone axis, causing considerable damage to the seeds.

Spruce seed moth, *Laspeyresia youngana* (Kft.) - This insect feeds mainly on the seeds. Larvae enter a seed, consume the contents, then progress to the next seed.

Lepidopterous larvae - The larvae belonging to this group were responsible for the majority of damage to cones in all cone samples. The larvae themselves were not present at the time of dissection so no positive identification could be made; however, based on the larvae present in the flower survey most of the damage was probably caused by the spruce budworm, with some additional feeding attributable to the spruce coneworm. Three spruce bud moth larvae and two blackheaded budworm larvae were identified in the flower sample from Arnott Township, Hearst District.

An average of 96 cones was taken from each of the six areas in the Region. Of this number 64% were damaged. Seed loss in the damaged cones was estimated at 42% (Table 15).

Two of the areas sampled in Hearst District were within the current spruce budworm infestation. The location in Hanlan Township was an SPA and the area in Arnott Township was a Seed Tree Area. All of the cones in the area in Arnott Township were damaged with a seed loss of 90%.

An average of 172 flowers was sampled from each of three areas with 40% of the flowers suffering damage (Table 16). The most severe damage was in Arnott Township, Hearst District.

Table 15. Summary of white spruce seed and cone damage in the Northern Region in 1984.

Location (Twp)	No. of cones examined	Damaged cones (%)	Seed loss within damaged cones (%)	Principal cause of seed loss (in order of importance)
Chapleau District				
Peters	98	29	28	Lepidopterous larvae *Hylemya anthracina*
Gogama District				
Dublin	100	84	44	Lepidopterous larvae *Laspeyresia youngana*
Hearst District				
Arnott[a]	75	100	90	Lepidopterous larvae *Hylemya anthracina*
Hanlan[a]	100	85	34	Lepidopterous larvae *Hylemya anthracina*
Kirkland Lake District				
Burt	100	64	45	Lepidopterous larvae *Laspeyresia youngana*
Eby	100	24	10	Lepidopterous larvae *Laspeyresia youngana* *Dasineura rachiphaga*
Average	96	64	42	

[a] within current spruce budworm infestation

Table 16. Summary of white spruce female flower damage in the Northern Region in 1984.

Location (Twp)	No. of flowers examined	Damaged flowers %	No. of insects recovered		
			Spruce budworm	Spruce coneworm	Miscellaneous insects
Chapleau District					
Peters	114	12	2	0	0
Hearst District[a]					
Arnott	200	63	27	6	5
Kirkland Lake District					
Burt	202	46	50	1	0
Average	172	40			

[a] within current spruce budworm infestation

Black Spruce Root Rot Survey

A special survey was conducted to determine the presence and extent of internal decay in stands of black spruce in the Northern Region (Fig. 6). The percentage of decay at stump level is a good indicator of the amount of root rot present in black spruce.

Nine upland sites and five lowland sites were selected. Twenty-five trees were examined in stands where black spruce was the major species component. Two cores at right angles and 15 cm from ground level were extracted from the tree. If advanced rot or incipient rot in the form of stain was present it was measured and recorded. One disc from each of two affected trees from each plot was sent to the Great Lakes Forest Research Centre for culturing.

Two fungi that are known causes of stain and decay were recovered in the present survey. The fungus, *Inonotus tomentosus* (Fr.) Gilb., was the most common cause of root rot. This pathogen was cultured from seven of the plots and is capable of causing tree mortality and creating large stand openings (see photo page). With one exception sites where the fungus was found were all upland. Another fungus, *Merulius* sp., also capable of causing significant rot was recorded on an upland site. The average amount of decayed wood at 15 cm above ground level varied from 0.8 to 11.4%, and as many as 32% of the trees examined contained rot (Table 17).

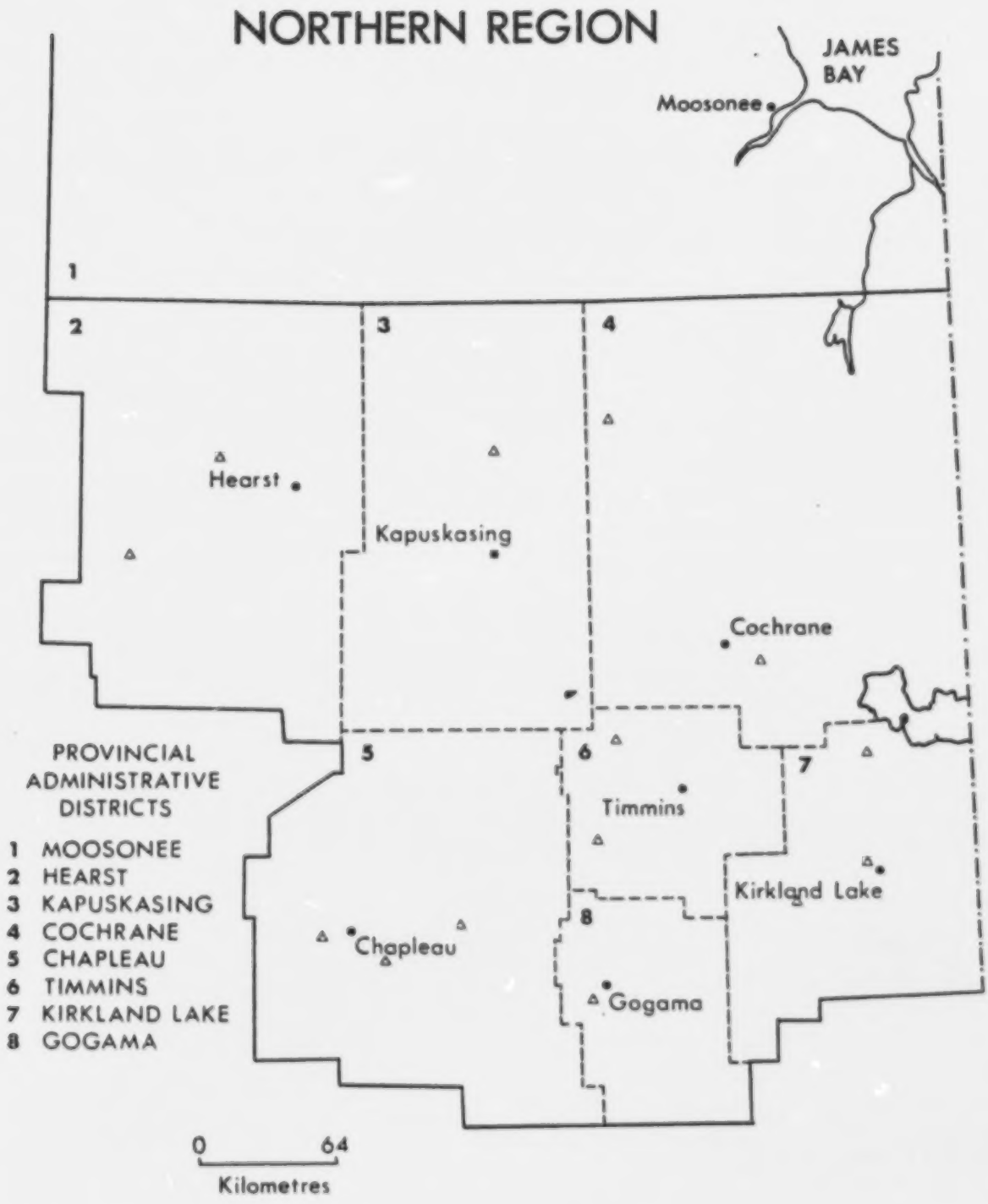


Figure 6. Black spruce (*Picea mariana* [Mill.] B.S.P.) stands surveyed for root rot during 1984 . . . . Δ

Table 17. Summary of the black spruce root rot survey in six districts in the Northern Region (data based on the examination of 25 trees at each location).

Location (Twp)	Avg DBH of trees (cm)	Avg tree age	Basal area host species (m^2/ha)	Site	No. of trees affected (%)	Avg amt of rot at 15 cm[a] (%)
Chapleau District						
Chapleau	16.9	51	12.0	upland	20	7.9
Gallagher	17.2	57	10.3	upland	32	2.6
Hellyer	22.3	71	8.0	lowland	20	2.9
Jack	17.9	57	13.0	upland	20	1.4
Timmins District						
Hillary	23.2	54	12.0	upland	4	1.7
Loveland	22.6	67	14.5	upland	12	2.4
Kirkland Lake District						
Cairo	20.4	41	15.0	upland	4	0.8
Grenfell	21.6	44	12.5	lowland	0	0
Munro	16.5	35	15.0	lowland	0	0
Cochrane District						
Sheldon	16.4	53	23.5	upland	8	1.9
Stimson	17.5	77	14.3	upland	24	11.4
Hearst District						
Frost	14.3	94	19.6	upland	20	8.1
Studholme	17.7	112	24.3	lowland	24	5.2
Kapuskasing District						
Guilfoyle	15.2	115	26.5	lowland	24	2.3

[a] height at which core was extracted.

Various nonpathogenic fungi were recovered from the plots. One such fungus, *Ascocoryne sarcoides* (Jacq. ex S.F. Gray) Groves and Wilson, was found on two plots and is suspected of inhibiting decay. The others, *Chlorosplenium aeruginascens* (Nyl.) Karst *Cordana pauciseptata* Preuss, *Cytospora* sp., *Gliocladium roseum* (Link) Bainier, *Hormodendrum* sp., *Penicillium* sp. and *Rhinocladiella* sp., were cultured from the submitted wood discs. They have the ability to stain the wood, but are found in both healthy and diseased trees.

Permanent Jack Pine Sample Plots

In 1982, six permanent plots of 300 trees each were established in jack pine regeneration stands under 2 m in height. Disease and insect levels as well as leader growth were monitored. These plots were re-examined for the third consecutive year in 1984. Two visits were made to each plot and the accumulated data were compiled for comparison with those of the previous year (Table 18).

An increase in leader growth was noted in all of the sample plots. Leader growth ranged from .37 m to .62 m with an average .48 m compared to .41 m the previous year.

Jack pine budworm was observed at only one location and associated damage was light. No larvae were collected from the plantation in Corkill Township, Kirkland Lake District which is near the present infestation. Populations of white pine weevil increased significantly in most of the plantations sampled. An average of 1.9% of the leaders were killed by the white pine weevil in 1984, while .8% were killed in 1983. A similar increase in damaged leaders was caused by the eastern pine shoot borer. A 14% increase in infested leaders was recorded over the previous year. Low numbers of jack pine sawflies and jack pine tip beetles were detected in the survey. Although it was the object of a specific search, no evidence of the Swaine jack pine sawfly was found.

A greater impact of root rot and stem rust organisms was observed in 1984 than in 1983. Armillaria root rot was found in five plots in 1984 compared with the previous year, when the disease was detected in only three plantations. Evaluations disclosed significant infections of stem rust in two areas. One survey produced an incidence of 3.1% stem infection, identified as sweetfern blister rust, in an area where no previous evidence of the disease had been recorded. Infections of western gall rust declined sharply probably because previous galls had killed the affected parts, and light infections of pine needle rust were recorded in one plantation. Although a diligent search was conducted, evidence of Scleroderris canker, *Gremmeniella abietina* (Lagerb.) Morelet, and tar spot needle cast, *Davisomycella ampla* (Davis) Darker, were not found.

Table 18. Summary of the results of a comparative survey of the permanent jack pine plots established in 1982 (counts based on the re-examination of 300 trees at each location)[a].

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Avg ht of trees at end of growing season (m)		Jack pine budworm				White pine weevil		Eastern pine shoot borer				Jack pine tip beetle	
					Trees affected (%)	Defoliation (%)	Trees affected (%)	Defoliation (%)	Trees affected		Leaders attacked (%)	Laterals attacked (%)	Leaders attacked (%)	Laterals attacked (%)	Leaders attacked (%)	
			1983	1984	1983		1984		1983	1984	1983		1984		1983	1984
Chapleau District																
Bliss	60	2,424	1.44	1.94	0	0	0	0	.3	1.0	1.0	0	1.7	0	0	.3
Gilliland	75	2,775	1.89	2.47	0	0	0	0	1.0	2.7	5.3	1.3	8.2	4.1	0	.3
Timmins District																
Robb	50	2,900	1.26	1.65	0	0	.3	< 1	0	.3	1.0	0	1.0	0	0	0
Kirkland Lake District																
Corkill	322	2,900	2.64	3.26	0	0	0	0	3.3	7.5	4.3	0	4.4	0	0	1.0
Cochrane District																
Sheldon	93	2,700	.71	1.08	0	0	0	0	0	.3	0	0	1.0	0	0	0
Hearst District																
Cross	220	2,541	1.07	1.48	1.3	<1	0	0	0	0	.7	1.0	0	0	0	0

[a] Some plots may have <300 trees in the current survey because of mortality.

(continued)

Table 18. Summary of the results of a comparative survey of the permanent jack pine plots established in 1982 (counts based on the re-examination of 300 trees at each location) [a] (concluded).

Location (Twp)	Estimated no. of trees per ha	Estimated no. of trees per ha	Avg ht of trees at end of growing season (m)		Armillaria root rot		Stem rust		Western gall rust		Pine needle rust	
					Trees affected (%)		Trees affected (%)		Trees affected (%)		Average foliar damage (%)	
			1983	1984	1983	1984	1983	1984	1983	1984	1983	1984
Chapleau District												
Bliss	60	2,424	1.44	1.94	.3	.3	1.7	.7	.3	0	<1	0
Gilliland	75	2,775	1.89	2.47	.7	.3	0	0	2.3	1.7	0	0
Timmins District												
Robb	50	2,900	1.26	1.65	0	.3	0	3.1	0	0	0	0
Kirkland Lake District												
Corkill	322	2,900	2.64	3.26	0	.3	0	0	0	0	0	0
Cochrane District												
Sheldon	93	2,700	.71	1.08	0	0	0	0	0	0	0	0
Hearst District												
Cross	220	2,541	1.07	1.48	.3	.3	0	0	0	.3	<1	<1

[a] Some plots may have <300 trees in the current survey because of mortality.

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Pinewood nematodes kill the host tree by multiplying rapidly in the sapwood of branches and main stems, thereby disrupting the water flow within the tree. Needle discoloration, a change from green to yellow and finally to brown, is the first visible symptom expressed by infested pines. The symptom is preceded by a marked decrease in resin flow. Trees invaded by the nematode in the spring usually wilt and die by late summer, but some may wilt within three months of being infested. The nematodes are transferred from infested to healthy pines by sawyer, *Monochamus* spp., beetles.

Intensive surveys were carried out in jack pine stands where sawyer beetle damage was evident. Wilted and dying trees were sampled in 22 stands across the Region but no evidence of the nematode was found.

Acid Rain National Early Warning System

As part of a national survey to monitor the effects of acid rain on forest stands, two study plots were established in the Northern Region. The plots were located in stands of jack pine and black spruce, the major commercial tree species in the Region. Among the parameters measured on each plot were vertical and radial growth, crown structure, size and density, mortality and evidence of insect and disease attack. Foliage samples were taken for analysis of evidence of specific acid rain symptoms. The jack pine plot was located in Deans Township, Chapleau District and the black spruce plot in Hopkins Township, Kapuskasing District.

Gypsy Moth Pheromone Traps

Two traps were set out in each of 13 provincial parks in the Region to detect the presence of gypsy moth, *Lymantria dispar* (L.). This is an annual project in cooperation with Agriculture Canada to monitor the spread of this insect in Ontario. The traps, baited with a synthetic lure, were set out in campgrounds because the eggs can be transported by recreation vehicles travelling from infested areas. One adult moth was trapped in Nagagamisis Provincial Park in Hearst District.

Climatic Data

Weather records for three stations, the Kapuskasing, Earlton and Chapleau airports, have been included in this report (Tables 19, 20, 21). Weather plays an important part in insect development and the spread of infectious diseases, and is the cause of many noninfectious conditions such as frost and hail damage, winter drying or drought. It also affects the success of spray operations for insect control.

Current records indicate above normal rainfall for the months of May and June at the Earlton Airport, for June and July at the Kapuskasing Airport, and for the month of June at the Chapleau Airport. The excess rainfall might account for the increase in foliage diseases in the Northern Region.

Table 19. A comparison of mean temperature, total precipitation and their normal values (based on a 30-year period) at the Earlton Airport in 1984.

Month	Mean temp. 1984 (°C)	Normal temp. (°C)	Deviation from normal temp. (°C)	Total precip. 1984 (mm)	Normal precip. (mm)	Deviation from normal precip. (mm)
Jan.	-19.5	-16.3	- 3.2	32.3	56.4	-24.1
Feb.	- 7.3	-14.1	+ 6.8	54.3	47.2	+ 7.1
Mar.	- 9.4	- 7.6	- 1.8	22.9	58.0	-35.1
Apr.	6.1	1.9	+ 4.2	46.2	50.0	- 3.8
May	7.5	9.8	- 2.3	112.5	61.3	+51.2
June	15.1	15.2	- 0.1	116.4	89.2	+27.2
July	18.2	17.7	+ 0.5	127.3	80.8	+46.5
Aug.	17.6	16.2	+ 1.4	165.1	83.4	+81.7
Sept.	10.3	11.1	- 0.8	76.9	99.2	-22.3
Oct.	6.6	5.4	+ 1.2	58.9	70.0	-11.1
Nov.	1.6	2.5	- 0.9	71.3	70.6	+ .7
Dec.	-11.0	-12.6	+ 1.6	71.6	56.3	+15.3

Table 20. A comparison of mean temperature, total precipitation and their normal values (based on a 30-year period) at the Kapuskasing Airport in 1984.

Month	Mean temp. 1984 (°C)	Normal temp. (°C)	Deviation from normal temp. (°C)	Total precip. 1984 (mm)	Normal precip. (mm)	Deviation from normal precip. (mm)
Jan.	-21.4	-18.6	- 2.8	34.3	53.6	-19.3
Feb.	- 9.0	-16.2	+ 7.2	25.5	43.0	-17.5
Mar.	-12.3	- 9.4	- 2.9	61.6	55.4	+ 6.2
Apr.	5.1	0.5	+ 4.6	23.8	53.2	-29.4
May	7.0	8.3	- 1.3	33.1	74.3	-41.2
June	14.4	14.1	+ 0.3	179.7	84.7	+95.0
July	16.7	16.8	- 0.1	156.6	96.3	+60.3
Aug.	17.2	15.3	+ 1.9	45.1	92.5	-47.4
Sept.	9.0	10.0	- 1.0	88.1	94.4	- 6.3
Oct.	6.2	4.4	+ 1.8	67.4	77.4	-10.0
Nov.	- 3.2	- 4.4	+ 1.2	47.9	80.1	-32.2
Dec.	-15.1	-14.7	- 0.4	101.7	53.3	+48.4

Table 21. A comparison of mean temperature, total precipitation and their normal values (based on a 30-year period) at the Chapleau Airport in 1984.

Month	Mean temp. 1984 (°C)	Normal temp. (°C)	Deviation from normal temp. (°C)	Total precip. 1984 (mm)	Normal precip. (mm)	Deviation from normal precip. (mm)
Jan.	-19.0	-16.9	- 2.1	45.8	46.9	- 1.1
Feb.	- 7.2	-15.8	+ 8.6	17.5	34.5	-17.0
Mar.	-11.5	- 8.6	- 2.9	31.2	56.2	-25.0
Apr.	5.2	0.6	+ 4.6	23.0	59.3	-36.3
May	6.8	8.6	- 1.8	40.0	73.8	-33.8
June	14.8	14.3	+ 0.5	120.4	100.4	+20.0
July	16.4	16.8	- 0.4	78.6	81.8	- 3.2
Aug.	17.2	15.4	+ 1.8	70.2	86.2	-16.0
Sept.	9.3	10.4	- 1.1	79.2	101.5	-22.3
Oct.	6.4	4.9	+ 1.5	15.2	75.7	-60.5
Nov.	- 3.6	- 3.5	- 0.1	38.6	64.2	-25.6
Dec.	-15.0	-12.8	- 2.2	63.0	53.5	+ 9.5